



Volume 3

**Space Shuttle
Mission Chronology
2005 – 2006**

STS-114

(17th Space Station Flight)

Discovery

Pad B

114th shuttle mission
31st flight of OV-104
50th California landing

Crew:

Eileen Collins, commander (4th shuttle flight)
James Kelly, pilot (2nd)
Soichi Noguchi (JAXA), mission specialist (1st)
Stephen Robinson, mission specialist (3rd)
Andrew Thomas, mission specialist (4th)
Wendy Lawrence, mission specialist (4th)
Charles Camarda, mission specialist (1st)

Orbiter Preps:

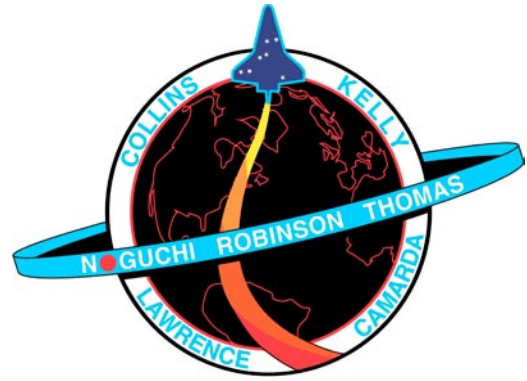
OPF – Aug. 22, 2001; Oct. 24, 2001; Jan. 28, 2002; March 8, 2002; April 24, 2002; June 20, 2002; Aug. 22, 2002; March 29, 2005 (rollover)
VAB – Sept. 17, 2001 (storage); Nov. 28, 2001 (storage); April 17, 2002 (storage); June 14, 2002; June 26, 2002; July 2, 2002 (transfer aisle); May 26, 2005 (rollback)
Pad A – April 6, 2005; June 15, 2005

Launch:

July 26, 2005, at 10:39 a.m. EDT. A liquid hydrogen tank low-level fuel cut-off sensor failed a routine prelaunch check during the launch countdown July 13, causing mission managers to scrub Discovery's first launch attempt. Members of an engineering team met to review data and possible troubleshooting plans. Some of the troubleshooting included conducting electromagnetic interference and ground resistance testing on wiring in the aft engine compartment. On July 26, the countdown was flawless and liftoff occurred on time.

Landing:

Aug. 9, 2006, at 8:11:22 a.m. EDT. On Runway 22, Edwards Air Force Base, Calif. Main gear touchdown: 8:11:36 a.m. Nose gear touchdown: 8:11:41 a.m. Wheel stop: 8:12:36 a.m. Rollout distance: 1.5 miles. Mission duration: 13 days, 21 hours, 32 minutes and 48 seconds. Landed on orbit 219. Logged 5.8 million miles. Waived off 2



landing opportunities Aug. 9 at KSC due to weather. Landed on first opportunity at EAFB, marking the 6th night landing at Edwards and the 50th Shuttle landing in California. Kennedy Space Center was beset with weather issues starting Aug. 7, the original landing date. Several landing opportunities at KSC were waived off Aug. 8 and again Aug. 9. Edwards was chosen as the preferred landing site.

Mission Highlights:

Discovery's climb to orbit was extensively documented through a system of new and upgraded ground-based cameras, radar systems and airborne cameras aboard high altitude aircraft. The imagery captured of Discovery's launch, and additional imagery from laser systems on Discovery's new Orbiter Boom Sensor System laser-scanner as well as data from sensors embedded in the Shuttle's wings, helped mission managers determine the health of Discovery's thermal protection system. When Discovery neared the Station early Thursday morning, Krikalev and Phillips used digital cameras and high-powered 800-mm and 400-mm lenses to photograph Discovery's thermal protective tiles and key areas around its main and nose landing gear doors. All imagery was downlinked to a team of 200 to analyze.

Before docking with the Space Station, Commander Eileen Collins performed the first Rendezvous Pitch Maneuver about 600 feet below the Station. The motion flipped the Shuttle end over end at 3/4 degree per second, allowing Expedition 11 crew members to photograph the underside of Discovery and its heat-resistant tiles in detail.

Imagery during launch showed a piece of foam being shed from the External Tank, as well as smaller tile and foam dings. Imagery of the tiles showed two areas where gap fillers were protrud-

ing. Mission managers spent several days to determine if any action would be required of the crew. They finally decided to allow Robinson attempt to pull out the protruding gap fillers with his hand or with forceps, or remove the protrusions with a hacksaw. The astronauts reviewed training for using the robotic arm and worked on assembling a hacksaw should they need it.

A puffed out piece of thermal blanket near the cockpit was identified in the imagery and became another area of concern. Tunnel tests at NASA's Amers Research Center in California and further engineering analysis showed there was little reason to be concerned about debris release during re-entry.

Prior to the first spacewalk, Mission Specialist Wendy Lawrence and Pilot James Kelly guided the Station's robotic arm, Canadarm2, to lift the Multi-Purpose Logistics Module Raffaello from Discovery's Cargo Bay for attachment to the Unity module. More inspection of Discovery was conducted by Mission Specialist Charles Camarda and Kelly.

During the mission, astronauts tested and examined tiles in demonstration of repair techniques.

Other time was spent transferring equipment and supplies on the Station as well as removing and stowing the same on the MPLM Raffaello for return to Earth.

Three spacewalks were planned and conducted, including an add-on task for the gap filler removal:

EVA No. 1 — 6 hours, 50 minutes.

Mission Specialists Stephen Robinson and Soichi Noguchi worked with tiles and reinforced carbon-carbon intentionally damaged on the ground and brought into space in Discovery's cargo bay. They tested an Emittance Wash Applicator for tile repair and Non-Oxide Adhesive eXperimental for the reinforced carbon-carbon samples. They also installed a base and cabling for a stowage platform and rerouted power to Control Moment Gyroscope-2, one of four 600-pound gyroscopes that control the orientation of the Station in orbit.

EVA No. 2 — 7 hours, 14 minutes.

Noguchi and Robinson removed the failed CMG-1 and stowed it. They moved the new CMG from the payload bay and installed it. Four functioning CMGs now serve the Space Station.

EVA No. 3 — 6 hours, 1 minute.

Attached to the Canadarm2, Robinson was moved to the site on Discovery's underside where he gently pulled the two protruding gap fillers from between thermal protection tiles. Other events were installing an external stowage platform outside the Station to house spare parts and installing a fifth Materials International Space Station Experiment (MISSE). MISSE 5 exposes samples of various materials to the harsh space environment for several months.

Mission managers added one more day to the mission, to follow the third spacewalk. Both the Discovery crew and Expedition 11 crew paid tribute to the Columbia crew and other astronauts and cosmonauts who have lost their lives in the human exploration of space.

The MPLM was unberthed from the Unity node using the robotic arm and placed back in Discovery's cargo bay. Discovery and the MPLM carried 7,055 pounds of unneeded equipment and trash. Both the Canadarm2 and OBSS were restored to their locations in the cargo bay.

STS-121

(18th Space Station Flight)

Discovery

Pad B:

115th shuttle mission
32nd flight of OV-103
62nd KSC landing

Crew:

Steven Lindsey, commander (4th shuttle flight)
Mark Kelly, pilot (2nd)
Piers Sellers, mission specialist (2nd)
Michael Fossum, mission specialist (1st)
Lisa Nowak, mission specialist (1st)
Stephanie Wilson, mission specialist (1st)
Thomas Reiter, mission specialist (1st), representing the European Space Agency (ESA)

Orbiter Preps:

OPF – Aug. 22, 2005

VAB – May 12, 2006

Pad B – May 19, 2006

Launch:

July 4, 2006, at 2:38 p.m. EDT. Launch of Discovery was scrubbed twice, July 1 and 2, due to weather concerns. After a day's standdown, the launch attempt resumed on July 4 and liftoff occurred on time.

Landing:

July 17, 2006, at 9:15 a.m. EDT. Runway 15 at KSC. Main gear touchdown: 9:14:43 a.m. Nose gear touchdown: 9:14:53 a.m. Wheel stop: 9:15:49 a.m. Rollout distance: 4.2 miles. Mission duration: 12 days, 18 hours, 37 minutes and 54 seconds. Logged 5.3 million miles. Landed on first opportunity at KSC, marking the 62nd landing at Kennedy.

Mission Highlights:

STS-121 was the second return-to-flight mission, demonstrating techniques for inspecting and protecting the shuttle's thermal protection system and replacing critical hardware needed for future station assembly. The mission also restored the station to a three-person crew for the first time since May 2003, leaving ESA astronaut Reiter aboard to join Expedition 13.

This was the most photographed shuttle mission in history, with more than 100 high-definition, digital, video and film cameras documenting the launch and climb to orbit. The images helped assess any damage sustained and potential risk for landing. In addition, the crew used the orbiter boom sensor system with a laser dynamic range imager, laser camera system and intensified television camera on the end, to examine the shuttle's nose cap, port wing, leading edge of the starboard wing, and outside of the crew cabin. No risk was found.

After docking to the station, the crew transferred the multi-purpose logistics module Leonardo to the Unity module from which they moved 7,400 pounds of supplies and equipment during their stay. The cargo included a new heat exchange for the common cabin air assembly that collects condensation out of the air on the station, a new window and window seals for the Microgravity Sciences Glovebox, and a spare U.S. extravehicular activity suit and emergency jet pack.

Astronauts performed three spacewalks:



EVA No. 1 — 7 hours, 31 minutes.

Mission Specialists Piers Sellers and Michael Fossum installed a blade blocker on the S0 truss in the zenith interface umbilical assembly to protect the undamaged power, data and video cable. They rerouted the cable through the IUA in order to move the mobile transporter rail car and replace the trailing umbilical system with the severed power and data cable. After that task, they tested the combination of the shuttle robotic arm and OBSS as a platform for spacewalking astronauts to repair a damaged orbiter if ever needed. The EVA was the fourth for Sellers and first for Fossum.

EVA. No. 2 — 6 hours, 47 minutes.

Sellers and Fossum restored the station's mobile transporter car to full operation, replacing the nadir-side trailing umbilical system, including a new interface umbilical assembly without a blade (the previous IUA had a blade, which inadvertently cut the cable that required the replacement). During the spacewalk, Fossum's emergency jet thruster backpack came loose on one side, requiring Sellers to secure it.

EVA No. 3 — 7 hours, 11 minutes.

The third and final spacewalk focused on testing repairs on thermal protection system reinforced carbon-carbon panels. Under evaluation was a pre-ceramic polymer sealant containing carbon-silicon carbide powder known as NOAX for use on damaged panels. Sellers and Fossum made three gouge repairs and two crack repairs. They also photographed the samples, as well as an area of Discovery's port wing. An added task during the EVA was removing the fixed grapple bar on the integrated cargo carrier in Discovery's payload bay.

and installing it on an ammonia tank inside the station's S1 truss to facilitate moving the tank on a later mission.

Refilled with 4,600 pounds of experiment samples, broken equipment and trash to be returned to Earth, Leonardo was moved back to Discovery's payload bay.

The return flight to Earth was delayed one day in order to add the third spacewalk. The mission management team determined there were enough consumables to extend the mission to test repair techniques and test a thermal imaging camera.

The trip home was one crew member short. Reiter remained behind to join Expedition 13, marking the first time since May 2003 that the station houses three crew members.

After unberthing from the station, the shuttle crew again used the robotic arm and boom sensors to inspect the starboard wing and nose cap heat shield. Still no concerns were noted.

**Space Shuttle Mission Chronologies Volumes 1 and 2
can be found on the Web at
<http://www-pao.ksc.nasa.gov/kscpao/nasafact/docs.htm>**